

Template IV: Quality Assurance/Quality Control Measures

Instructions

The implementation of quality assurance and quality control (QA/QC) procedures is an important part of the development of national greenhouse gas inventories. As described in the IPCC *Good Practice Guidance*, an adequate QA/QC program helps improve transparency, consistency, comparability, completeness, and confidence in national GHG emission inventories.

STEP 1:	Past QA/QC Program Description and Procedures
STEP 2:	Existing QA/QC Program Description and Procedures
STEP 3:	Proposed QA/QC Program Description

The CD-ROM accompanying this handbook contains two versions of the templates. The first is the electronic version of this document with all sample text and instructions included in light green. The second version, without the light green text, is the one in which countries should enter country-specific data, and which they should use for preparing final reports. In the final plan, all green text should be deleted.

Step-by-step instructions are listed above. Each step is explained in detail in the corresponding section of the template.

Quality Assurance/Quality Control Measures

Background

Quality assurance and quality control measures are sometimes not well differentiated. The measures may be differentiated as follows:

QA - a planned system of review, and sometimes audit, procedures conducted by personnel not involved in the inventory development process.

QC - a system of routine, planned technical activities implemented by the inventory development team to measure and control the quality of the inventory as it is being prepared.

IV.1 Past QA/QC Program Description and Procedures

[INSTRUCTIONS: Describe any QA/QC procedures that may have been followed for the last inventory. Questions about these procedures may include:

- *Did someone review estimates and activity data for the last inventory? If so, list this person's name and position. (This person may have other inventory responsibilities, such as Inventory Coordinator, Source Lead, etc.)*
- *Were QA/QC procedures performed for past inventories? Describe, for example, which procedures were used:*
 - *Were data sources documented? How?*
 - *Were spreadsheet totals checked against document tables and text?*
 - *Were annual trends checked for unreasonable values (for example, outliers in activity data)?*
- *Did anyone review estimates and/or methods? (Explain what is assumed or understood from the previous inventory. Indicate whether an unofficial process may have existed. If it is clear that no process was in place, indicate this as well. Also, indicate whether a consultant was supposed to have undertaken this process.)*
- *Were any problems encountered with QA/QC? Is there any documentation of these problems and how they were addressed?]*

IV.2 Existing QA/QC Program Description and Procedures

[INSTRUCTIONS: Describe any QA/QC procedures that are presently being followed. Questions about these procedures may include:

- *Who reviews estimates and activity data? List this person's name and position. (This person may have other inventory responsibilities, such as Inventory Coordinator, Source Lead, etc.)*
- *What QA/QC procedures are presently being followed?*
 - *Are data sources documented? How?*
 - *Are spreadsheet totals checked against document tables and text?*
 - *Are annual trends checked for unreasonable values (for example, outliers in activity data)?*
- *Does anyone review estimates and/or methods? (Describe any expert review methods or practices that are being used for particular sources. Indicate whether an unofficial process exists. If it is clear that no process is in place either overall or for particular sources, indicate this as well. Also, indicate whether a consultant reviews inventory estimates, etc.)]*

IV.3 Proposed QA/QC Program Description

The following sections describe the QA/QC plan that [Country] plans to follow to ensure a high quality national inventory.

IV.3.1 Describe Roles and Responsibilities

The role of QA/QC Coordinator has been assigned to [name and position]. The QA/QC Coordinator will be responsible for ensuring that adequate QA/QC is performed on the inventory and its supporting documents and spreadsheets. The QA/QC Coordinator is also responsible for ensuring that all team members know their QA/QC responsibilities, as well as for clarifying who is responsible for QA/QC at various levels. This requires the QA/QC Coordinator to:

- Ensure that the procedure for communicating the QA/QC plan (See Section IV.3.2, below) is carried out effectively.
- Create a checklist of QA/QC procedures for team members to follow. [For examples, consult U.S. EPA's *Procedures Manual for Quality Assurance/Quality Control and Uncertainty Analysis*, which can be obtained by emailing GHGInventory@epa.gov or UNDP's National Communication Support Program (NCSP) Guidance Document, *Managing the National Greenhouse Gas Inventory Process*, at http://ncsp.undp.org/report_detail.cfm?Projectid=153.]
- Collect and review checklists for completeness, and follow up as necessary to ensure that required QA/QC procedures are observed.
- Assign QA/QC tasks to [list specific staff position, such as source leads].

- Deliver QA/QC documentation to Archiving Coordinator (or Inventory Coordinator).
- Invite technical review from other institutions, other countries (i.e., Annex 1 countries), or regional organizations as needed.

[List any additional responsibilities.]

IV.3.2 Procedure for Communicating the QA/QC Plan

It is essential to communicate the contents of the QA/QC plan to inventory team members and outside experts so that its procedures can be effectively implemented and evaluated. The QA/QC Coordinator for [Country] will implement the following procedures for communicating the QA/QC plan:

- Convene a meeting with all team members to develop a QA/QC plan.
- Write and distribute a QA/QC plan to all who need to perform QA/QC.
- Conduct a "kick-off" meeting with all those working on inventory (including consultants, universities, etc.).
- Send memos (written or electronic) reminding team members of their QA/QC responsibilities.

[List any other communication activities.]

IV.3.3 Minimal QC Procedures

A minimal standard or set of QC procedures should be followed each year for all source and cross-cutting estimates and data to ensure that basic standards of quality are met. [Country] will implement the following minimal Tier 1 procedures annually:

The QA/QC Coordinator should:

- Ensure total GHG emissions equal the sum of the individual sectors or sources.
- Ensure that total GHG emissions equal the sum of emissions by gas.
- Compare data in tables to calculation spreadsheets and to text to ensure that all report the same estimates.
- Ensure that parameters used in multiple categories (e.g., population) are consistent across categories.

- Ensure that the emissions data is reported in a manner consistent with the calculation tables in the Non-Annex 1 National Communications Reporting Guidelines.
- Ensure that estimation methods comport with IPCC guidelines.

Each Source Lead should:

- See Annex 1.

[List any additional procedures.]

IV.3.4 Additional Procedures

In addition to the minimal QC procedures outlined in the preceding section, additional Tier 1 and Tier 2 QC procedures should be followed for select key sources and, as time allows, for other sources. Key source categories for [Country] are [name key source categories].

Additional QC procedures may include the following:

[List QC procedures that may be implemented. Examples of such procedures include:

- *If applicable, compare current inventory to past inventories for consistency.*
- *Ensure that emission estimates are correct order of magnitude.*
- *Communicate periodically with organizations supplying data to be aware of changes, gaps, etc. Inventory team could provide useful feedback to improve quality and type of data collected, which could have benefits for other users.*
- *Given the specific situation of [Country, assess whether default emission factors are representative.*
- *Seek out more representative data (activity data, emission factors, etc.).*
- *Document limitations of source (activity) data (e.g., bias or incompleteness).*
- *Use the archiving procedure to track and document changes in methodology within each source spreadsheet, as well as to track completeness of file annually.]*

IV.3.5 External Review QA Procedures

External reviews by experts offer the opportunity to uncover technical issues related to the application of methodologies, selection of activity data, and development and choice of emission factors. Because of their knowledge and experience in areas related to the inventory, the listed experts and/or organizations indicated in Annex 2, below, will be sent a draft of the inventory for review [XX (suggest at least 2)] months before publication. Their comments will be reviewed and addressed, as appropriate, prior to public release or submission of the inventory.

The QA/QC Coordinator should:

- Invite technical review from experts (QA) as scheduled, or more frequently when needed.
- Create peer review questionnaires for experts to complete (Annex 3 of the UNDP Manual provides examples of Peer Review Questions).
- Ensure that comments are addressed by appropriate sector leads.
- Archive comments and responses from the peer reviews.
- Insert table of potential individuals and institutions to be involved, see example in Annex 2, below.

IV.3.6 Overall Schedule

[INSTRUCTIONS: Develop this section in accordance with the Inventory Cycle proposed in the Institutional Arrangements Template. The following should be considered when developing the schedule:

- *Develop QC plan and overall QC timeline.*
- *QC checklists should be distributed to source leads at kick-off meeting. Communication of the QA/QC plan should also take place at this point.*
- *Completed QC checklists should be submitted at the same time as completed sector text and spreadsheets.*
- *Errors discovered through QC checks should be corrected immediately, or specific notes regarding the problem should be made and all corrections should be made at a specified later date (for example, as changes from an external review are being incorporated).*

- *External review comments should be received at least 2 months before finalizing your country's inventory chapter of the National Communications and/or before submission of the National Communications to the UNFCCC, to provide time to incorporate changes.*
- *Indicate in QC timeline when external review will occur.]*

ANNEX 1 – Examples of QC Procedures

QC Activity	Procedures
Check that assumptions and criteria for the selection of activity data and emission factors are documented.	<ul style="list-style-type: none"> • Cross-check descriptions of activity data and emission factors with information on source categories and ensure that these are properly recorded and archived.
Check for transcription errors in data input and reference.	<ul style="list-style-type: none"> • Confirm that bibliographical data references are properly cited in the internal documentation. • Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors.
Check that emissions are calculated correctly.	<ul style="list-style-type: none"> • Reproduce a representative sample of emissions calculations. • Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.
Check that parameter and emission units are correctly recorded and that appropriate conversion factors are used.	<ul style="list-style-type: none"> • Check that units are properly labeled in calculation sheets. • Check that units are correctly carried through from beginning to end of calculations. • Check that conversion factors are correct. • Check that temporal and spatial adjustment factors are used correctly.
Check the integrity of database files.	<ul style="list-style-type: none"> • Confirm that the appropriate data processing steps are correctly represented in the database. • Confirm that data relationships are correctly represented in the database. • Ensure that data fields are properly labeled and have the correct design specifications. • Ensure that adequate documentation of database and model structure and operation are archived.
Check for consistency in data between source categories.	<ul style="list-style-type: none"> • Identify parameters (e.g., activity data, constants) that are common to multiple source categories and confirm that there is consistency in the values used for these parameters in the emissions calculations.
Check that the movement of inventory data among processing steps is correct.	<ul style="list-style-type: none"> • Check that emissions data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. • Check that emissions data are correctly transcribed between different intermediate products.
(Lower priority) Check that uncertainties in emissions and removals are estimated or calculated correctly.	<ul style="list-style-type: none"> • Check that qualifications of individuals providing expert judgment for uncertainty estimates are appropriate. • Check that qualifications, assumptions, and expert judgments are recorded. Check that calculated uncertainties are complete and calculated correctly. • If necessary, duplicate error calculations or a small sample of the probability distributions used by Monte Carlo analyses.

(cont.)

ANNEX 1 – Examples of QC Procedures (cont.)

QC Activity	Procedures
Undertake review of internal documentation.	<ul style="list-style-type: none"> • Check that there is detailed internal documentation to support the estimates and enable duplication of the emission data. • Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. • Check integrity of any data archiving arrangements of outside organizations involved in inventory preparation.
Check methodological and data changes resulting in re-calculations.	<ul style="list-style-type: none"> • Check for temporal consistency in time series input data for each source category. • Check for consistency in the algorithm/method used for calculations throughout the time series.
Undertake completeness checks.	<ul style="list-style-type: none"> • Confirm that estimates are reported for all source categories. • Check that known data gaps that result in incomplete source category emissions estimates are documented.
Compare estimates to previous estimates.	<ul style="list-style-type: none"> • For each source category, compare current inventory estimates to previous estimates. If there are significant changes or departures from expected trends, re-check estimates and explain any difference.

ANNEX 2 – Example Table of Experts for External Review of National Greenhouse Gas Inventory

Reviewer (Name)	Affiliation/Organization	Sector or Source Category
Dr. Jose Fida	National Academy of Sciences, University of Panama	N ₂ O Agricultural Soils
Mariella Perez	Agriculture Center of Panama	...